



Ethanol Study Report

SIPRAC

September 14, 2006

Ethanol Study Report to Legislature

- An Act Concerning Protection of Public Water Supply Resources: Public Act 06-53 Section 6.
- Due on December 31, 2006.
- DEP to study effect on Connecticut's air quality of using ethanol in gasoline.
 - Effect on emissions and attainment of NAAQS
- DPH to study health implications.

Ethanol Study Report Requirements

- Update NESCAUM/NEIWPCP reports.
- Analysis of whether to continue use.
- Effect on air quality.
- Update on other states' actions.
- Recommendations for alternative or supplemental emission reduction opportunities.
- Must be completed within available resources, no funding appropriated.

What is Ethanol?

- Alcohol: $\text{C}_2\text{H}_5\text{OH}$ -denatured.
- Originally added to gasoline as an oxygenate.
- Oxygenates promote more complete fuel combustion.
- Increases octane.

Why We Have Ethanol in Connecticut

- Originally MTBE used as octane enhancer.
- 1992: Served as a CO control measure.
- 1995: Suppliers added MTBE to meet oxygenate requirement.
- Concerns with groundwater contamination.
- January 1, 2004 statutory ban prohibiting sale of MTBE as a gasoline additive: Public Act 03-122.
- Ethanol was only viable option to meet oxygenate requirement.

Ethanol in Connecticut Gasoline

- Refiners choose to blend ethanol at 10% by volume (3.5% oxygen by weight).
 - Federal Tax Incentives
 - 5.7% ethanol by volume complies with 2.0% oxygen
- Connecticut and other New England states currently have a 10% Ethanol blend.

Energy Policy Act of 2005

- Signed into law August 8, 2005.
- Eliminated RFG 2.0% Oxygen by weight requirement.
 - Effective May 6, 2006
- Eliminated oxygenate requirement waiver process.
- Introduction of Renewable Fuels Standard (RFS).
 - Designed to reduce dependence on foreign oil

Renewable Fuels Standard (RFS)

- 2.78% of fuel sold in 2006 must be from renewable sources (4.0 billion gallons).
- EPA announced rulemaking proposal to increase to 3.71% for 2007 (4.7 billion gallons).
- By 2012, RFS increases to 7.5 billion gallons.

Ethanol Production

- ~100 ethanol plants in US.
- Producing 4.8 billion gallons ethanol in 2006.
- 46 new ethanol plants under construction.
- 140 billion gallons gasoline used in the US/year.

Existing Studies for Consideration

- No funding was provided for this study.
- Efforts focused on existing studies to inform the General Assembly on issue.
- Several studies by CARB and Coordinating Research Council (CRC) that looked at HC, NO_x and toxics.

California Ethanol Studies

2002 Fuel Permeation

- In 2002 CARB and CRC co-funded permeation study.
- Permeation is diffusion of fuel through rubber and plastic components of fuel and fuel vapor systems.
- 3 Fuels studied:
 - 11% volume MTBE
 - 5.7% volume ethanol
 - Non-oxygenated

California Ethanol Studies

2002 Fuel Permeation

- Permeation Results.
 - All vehicles ethanol > MTBE
 - Most vehicles ethanol > non-oxygenated
 - 65% or 1.4 grams/day more than MTBE fuel
 - 45% or 1.1 grams/day more than non-oxygenated fuel
 - 2X increased permeation for each 10° C rise in T
 - Ozone reactivities very similar for all 3 fuels
 - MTBE and ethanol statistically equal
 - Non-oxygenated statistically higher than MTBE and ethanol

California Ethanol Studies

2005 Fuel Permeation

- Additional study building on 2002 results.
- Stakeholder process ongoing.
- Final report expected, no release date yet.
- Investigated 5 fuels:
 - E0 – Non-oxygenated base
 - E6 – 5.7 volume % Ethanol
 - E6Hi – 5.7 volume % Ethanol with increased aromatics
 - E10 – 10 volume % Ethanol
 - E85 – 85 volume % Ethanol

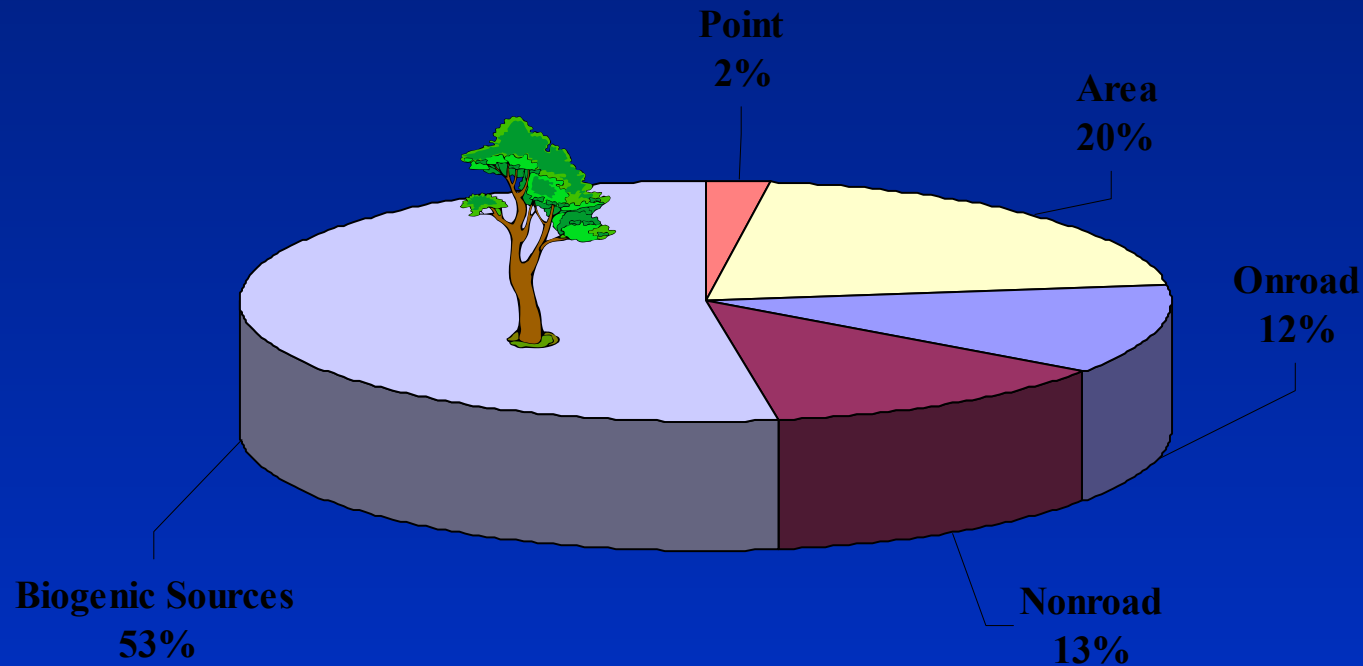
California Ethanol Studies

2005 Fuel Permeation

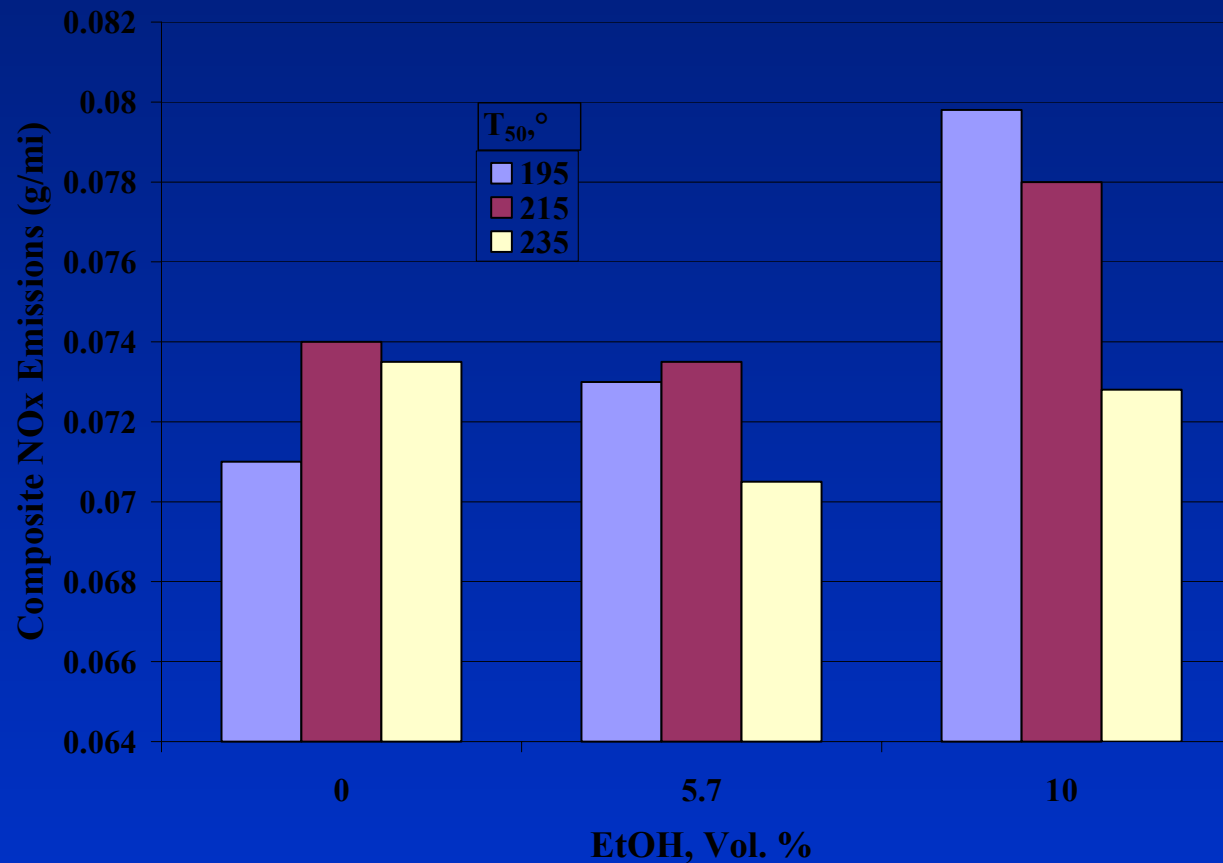
- Modeling total evaporative emissions shows additional 25 TPD of HC in CA from 10% ethanol.
- Roughly equivalent to 2.5 TPD for CT; 0.33% of inventory.
- Future review required of other studies and the impact of the RFS rulemaking.

2002 Connecticut Emission Inventory

VOC: 752 Tons per Day

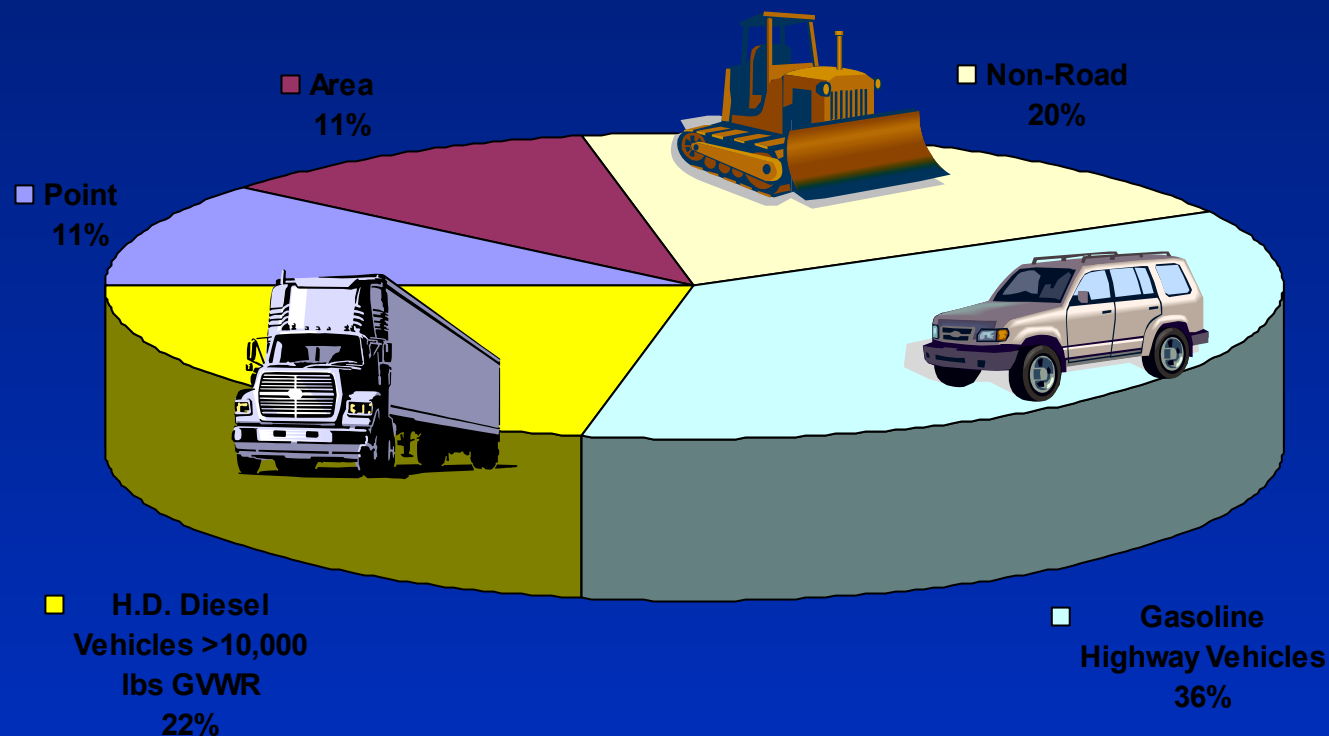


CRC Report NO_x Data



2002 Connecticut Emission Inventory

NO_x: 118,704 Tons/Year



CRC 2006 Study

Effects of Ethanol and Volatility Parameters on Exhaust Emissions

- Analysis of Non-methane organic gas (NMOG) and 4 air toxics:
 - Formaldehyde
 - Acetaldehyde
 - Benzene
 - 1,3-Butadiene
- Analysis on fuels with High T90 (355° F).

CRC 2006 Study

Effects of Ethanol and Volatility Parameters on Exhaust Emissions

- All toxics measured increased emissions when:
 - Fuel properties changed from low to high T
 - Ethanol increased from zero to 10%
 - Increases ranged from 14 to 73%
- Fuel studied does not represent fuel sold in Connecticut.
- Study results cannot predict amplitude of Connecticut toxics exhaust emission increases.

Conclusions

- Consulting with NESCAUM for further analysis and interpretation of studies.
- More evaluations need to be conducted.
- Listing of resources will be on SIPRAC website.



Questions ?

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